

1/25/18 "Hope is an accelerant."-Mrs. Lenoci

HW: "Synthetic Division of Polynomials" worksheet #2-10 even

AIM: How do we use Synthetic Division?

Warm Up:

1) Use long division to divide:

$$\begin{array}{r}
 (2x^3 - 9x^2 + 10x - 7) \div (x - 3) \\
 \hline
 2x^2 - 3x + 1 + \frac{-4}{x-3} \\
 \hline
 x-3 \overline{) 2x^3 - 9x^2 + 10x - 7} \\
 \underline{-(2x^3 - 6x^2)} \phantom{+ 10x - 7} \\
 -3x^2 + 10x \phantom{- 7} \\
 \underline{-(-3x^2 + 9x)} \phantom{- 7} \\
 x - 7 \\
 \underline{-(x - 3)} \\
 -4
 \end{array}$$

Is there another way to find the quotient and remainder of the warm up?

### Synthetic Division

$$(2x^3 - 9x^2 + 10x - 7) \div (x - 3)$$

#### Steps

- 1) First, write the coefficients ONLY inside an upside-down division symbol:

$$\begin{array}{r|rrrr} & 2 & -9 & 10 & -7 \end{array}$$

- 2) Solve the divisor for  $x$  and place that value outside

$$x - 3 = 0$$

$$x = 3$$

$$\begin{array}{r|rrrr} 3 & 2 & -9 & 10 & -7 \end{array}$$

- 3) Take the first number inside, representing the leading coefficient, and carry it down, unchanged, to below the division symbol:

$$\begin{array}{r|rrrr} 3 & 2 & -9 & 10 & -7 \\ & 2 & & & \end{array}$$

- 4) Multiply the outside value by the carry down value and place that number under the second coefficient

$$\begin{array}{r|rrrr} 3 & 2 & -9 & 10 & -7 \\ & 2 & 6 & & \end{array}$$

- 5) Add down the column:

$$\begin{array}{r|rrrr} 3 & 2 & -9 & 10 & -7 \\ & 2 & 6 & & \\ \hline & 2 & -3 & & \end{array}$$

- 6) Multiply the result by the outside value and place the result under the third coefficient

$$\begin{array}{r|rrrr} 3 & 2 & -9 & 10 & -7 \\ & 2 & 6 & -9 & \\ \hline & 2 & -3 & 1 & \end{array}$$

- 7) Repeat the process until there are no columns remaining

$$\begin{array}{r|rrrr} 3 & 2 & -9 & 10 & -7 \\ & 2 & 6 & -9 & 3 \\ \hline & 2 & -3 & 1 & -4 \end{array}$$

- 8) The last value is the remainder and the remaining values are the coefficients of the quotient, right to left in ascending order

$$2x^2 - 3x + 1 + \frac{-4}{x - 3}$$

Use Synthetic Division to find the quotient and remainder of the following:

1)  $(x^3 - 2x^2 - 5x + 6) \div (x - 3)$

$x - 3 = 0$   
 $x = 3$

$$\begin{array}{r|rrrr} 3 & 1 & -2 & -5 & 6 \\ & \downarrow & \oplus & \oplus & \oplus \\ & 3 & 3 & -6 & \\ \hline & 1 & 1 & -2 & 0 \end{array}$$

$x^2$     $x$    constant   ← remainder

$$x^2 + x - 2 + \frac{0}{x-3}$$

3)  $(2x^3 + x^2 - 3x + 7) \div (x + 1)$

$x + 1 = 0$   
 $x = -1$

$$\begin{array}{r|rrrr} -1 & 2 & 1 & -3 & 7 \\ & \downarrow & -2 & 1 & 2 \\ \hline & 2 & -1 & -2 & 9 \end{array}$$

$$2x^2 - x - 2 + \frac{9}{x+1}$$

5)  $(x^4 - 3x^3 + 7x^2 - 2x + 1) \div (x + 2)$  —  $x + 2 = 0$   
 $x = -2$

$$\begin{array}{r|rrrrr} -2 & 1 & -3 & 7 & -2 & 1 \\ & \downarrow & \oplus & \oplus & \oplus & \oplus \\ & -2 & 10 & -34 & 72 & \\ \hline & 1 & -5 & 17 & -36 & 73 \end{array}$$

$$x^3 - 5x^2 + 17x - 36 + \frac{73}{x+2}$$

7)  $(3x^4 + x^3 - 2x + 3) \div (x + 1)$

$x + 1 = 0$   
 $x = -1$

no  $x^2$

$$\begin{array}{r|rrrrr} -1 & 3 & 1 & 0 & -2 & 3 \\ & \downarrow & \oplus & \oplus & \oplus & \oplus \\ & -3 & 2 & -2 & 4 & \\ \hline & 3 & -2 & 2 & -4 & 7 \end{array}$$

$$3x^3 - 2x^2 + 2x - 4 + \frac{7}{x+1}$$

9)  $(x^4 - 16) \div (x - 2)$

$x - 2 = 0$   
 $x = 2$

$$\begin{array}{r|rrrrr} 2 & 1 & 0 & 0 & 0 & -16 \\ & \downarrow & \oplus & \oplus & \oplus & \oplus \\ & 2 & 4 & 8 & 16 & \\ \hline & 1 & 2 & 4 & 8 & 0 \end{array}$$

no remainder

$$x^3 + 2x^2 + 4x + 8$$

